sion, are so arranged that one group culminates in the evening and another in the morning hours. The range of the variation in latitude, given in the final corrected results, is 0″.44, and the probable error of a single determination is 0″.134. Two maxima and minima are covered in the period of observations, the range of the maximum and minimum in the middle of the series being somewhat less than the extreme range. Among the interesting details brought out in the critical discussion are: that the value of the micrometer screw is variable from other causes than change of temperature; that the deduced constant of aberration is unexpectedly large, viz., 20″.580, and that the same pairs of stars gave results on different nights which differed occasionally by many times the computed probable error of the observation. No satisfactory explanation of this anomaly has been found. The corresponding anomaly in longitude work is plausibly explained by variation in personal equation of the observers, but it is not easy to apply this explanation to zenith telescope observations.

CHAMBERLIN OBSERVATORY OF THE UNIVERSITY OF DENVER.

Professor Howe continues to make micrometric observations of superior excellence with the Bruce micrometer attached to the 20-inch equatorial. His careful work upon the fainter nebulæ has been embodied in two communications to the Royal Astronomical Society which are published in Monthly Notices, Vol. LVIII., Nos. 6 and 9. The extensive series of observations of Eros from September 12, 1898, to April 6, 1899, is given in the *Astronomical Journal*, No. 463.

ASTRONOMICAL OBJECTIVES.

Zeiss's new catalogue calls attention to the improvements in objectives which have resulted from recent studies encouraged by the varieties of glass manufactured at Jena. The price lists include six or more special combinations having individual excellences. The binary apochromatic lens with ratio of aperture to focal length 1:17 to 1:20 nearly eliminates the secondary spectrum, as does König's combination of one flint and two crown of shorter focus (ratio 1:10 to 1:15) which is styled the triple apochromatic lens. The ordinary silicate glasses are used as heretofore with long focus (ratio 1:15 to 1:18) by Fraunhofer's formula, and there is also a lens of longer focus especially adapted for astrophotographic purposes. Short-focus lenses are represented by a triple lens with ratio 1:4 to 1:6 designed for finders and a binary lens with flat field, both of which have an uncorrected secondary spectrum. It would be interesting to learn how many of these special combinations will come into actual use.

Winslow Upton.

Providence, R. I.,
August 10, 1899.

NOTES ON PHYSICS.

The London *Electrician* states that on July 3d Lord Kelvin sent to the Royal Society the following in a telegram: "An electrified body is set into rotation by the generation of a magnetic field around it. The magneto-optical phenomena discovered by Faraday, Kerr and Zeeman are to be thus explained." In the next issue of the paper a letter from Lord Kelvin states that this announcement was not based on experimental results, but deduced from the current that flows in a metallic conductor at right angles to a growing magnetic field. The telegram is discussed editorially and in a letter by G. F. Fitzgerald. The point seems to be that the growth of the field will cause a displacement of the charge round the body which will be the equivalent of a momentary current, and that this reacting on the field will cause rotation, which, if the body is frictionless, will continue till the stopping of the field produces an equal opposite torque. Fitzgerald states that he has considered this matter, but doubts if the forces will be great enough to permit of experimental demonstration. In the same issue, and in connection with this matter, S. P. Thomson describes and discusses a phenomenon presented to the Royal Society by C. E. S. Phillips, in which a vacuum tube having iron electrodes which can be powerfully energized by an external electromagnet is used. When a discharge has been sent through the tube, and then cut off, even for so long as ten minutes, and then the magnets are energized, a brightly luminous ring forms normal to the field, and

rotates rapidly, the direction of rotation depending upon that of the field, but not of the discharge. This, Thomson explains by electrified molecules passing inward from the walls of the tube and set in rotation by the growing field.

IN the London *Electrician* of July 7th P. A. C. Swinton describes experiments upon the incandescence of Thoria and Ceria as heated by bombardment in a vacuum tube. He states that in the Bunsen flame Thorium oxid and Cerium oxid give about the same degree of incandescence, and that the addition of one per cent. of the latter to the Thorium oxid, as in the Wellsbach mantle, increases the incandescence about eleven times. In the vacuum tube, however, the ceria was but a dull red, when the thoria was at full incandescence, and the same was true of a mixture of half and half; further the addition of the one per cent. of ceria to the thoria increased the incandescence only about five per cent. This seems to favor the theory that chemical action takes place in the action of the Wellsbach mantle. The energy used was about one watt per candle.

F. C. C.

NOTES ON INORGANIC CHEMISTRY.

ATTENTION was recently called to the researches of Armand Gautier on the occurrence of iodin in ocean water. A continuation of his work takes up the iodin in the water of the Mediterranean Sea. The surface water, like that of the Atlantic Ocean, contains no iodids or iodates, but the iodin is present either in microscopic organisms or in complex organic compounds containing also nitrogen and phosphorus and capable of dialysis. The total amount of iodin present is the same for all depths, but varies in its form. Thus at the bottom of the sea iodids and iodates are present to the extent of 0.305 milligrams per liter, while they are zero at the surface. Of iodin in living organisms there is a maximum at the surface and none at the bottom. The soluble organic iodin is more constant, though varying to some extent with a maximum at 880 meters depth. The total iodin present is 2.25 mg. per liter, which is but little less than the 2.40 mg. found in the water of the Atlantic Ocean.

THE same number of the *Comptes Rendus* contains an account of the preliminary work by F. Garrigon on the occurrence of rare metals in water. He finds evidence of the presence of a number of unexpected metals, particularly those of the copper and tin groups. As titanium has been found not only as a constant constituent of almost all soils by Dunnington ; but of many, if not all, plants by Wait; and of animals including man — unpublished work of Wait (Univ. of Tenn.), Toole (Wash. & Lee.), and Baskerville (Univ. of N. C.)—it is not unnatural that traces of it should be found in mineral waters.

ONE of the greatest drawbacks to work on the element fluorin has been that the apparatus used must be of platinum or fluor spar. Moissan has, however, now shown that copper vessels can be used even for the electrolysis of hydrofluoric acid, being less attacked than other metals. The cause of this appears to be that there is formed on the surface of the copper a very thin layer of the fluorid of copper, which is wholly insoluble in hydrofluoric acid, and, of course, unattacked by free fluorin.

THREE papers have recently been read before the Chemical Society of London by Harold B. Dixon, which are of considerable interest. The first is on the combustion of carbon bisulfid. He finds it burns in the air with phosphorescence, which, however, begins to appear at 230°, while real ignition does not begin till 232° is reached. Carbon bisulfid is not decomposed by leading through a tube at 400°. It can be detonated by a heavy blow, but the explosion is not propagated through the vapor. The rapidity of explosion is greatest when exactly sufficient oxygen for combustion is present.

A SECOND paper is on the combustion of coal. It is ordinarily accepted that carbon burns directly to carbon dioxid and that this is subsequently reduced by the excess of carbon to carbon monoxid. Professor Dixon finds that when a mixture of air and carbon monoxid is passed slowly over coal at 500° the amount of carbon monoxid is unchanged, but the oxygen disappears completely by union with carbon to form carbon dioxid. On the other hand, if a mixture of 20% carbon monoxid and 80% oxygen is used, and the current is very slow, the